



# A qualitative study of annoyance caused by floor impact sounds in apartment buildings

Sang Hee Park

Acoustics Research Unit, School of Architecture, University of Liverpool, Liverpool, L69 7ZN, UK

Pyoungh Jik Lee

Acoustics Research Unit, School of Architecture, University of Liverpool, Liverpool, L69 7ZN, UK

## Summary

A qualitative study was conducted to investigate how residents in apartment buildings perceive and are affected by floor impact sounds. Semi-structured interviews were conducted in South Korea and Grounded Theory was used to analyse the data. Through three coding phases of Grounded Theory (open, axial and selective), verbatim transcripts of each interview were probed and the relationship between non-acoustic factors and noise annoyance was formulated. It was found that past experience of the issue, actual disturbance and each individual's noise sensitivity influenced noise annoyance as causal conditions. In addition, the development from noise annoyance to coping behaviours was discovered to be influenced by intervening conditions: empathy and house or neighbourhood satisfaction. As consequences of individuals' coping behaviours, having negative attitudes to the issue or relevant authorities, considering moving house as avoidance behaviour, health and relationship problems were identified.

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## 1. Introduction

Multi-residential buildings are the most common type of dwelling in South Korea [1] and noise annoyance caused by floor impact sounds is one of the major issues that residents in apartment buildings experience. There have been several studies on noise annoyance caused by environmental noise sources such as road traffic [2-5], aircraft [6-8] and wind turbines [9-11]. Previous studies on floor impact sounds [12-15] have mainly focused on quantitative assessments of noise annoyance highlighting the effects of acoustic features on subjective responses. However, it has been revealed that acoustic factors alone cannot explain noise annoyance.

There is vast variability in each individual's responses to noise [16-18] and the causes of the variations are only partially discovered [17, 19], thus, this research employed a qualitative research method and sought to comprehend the issue of floor impact sounds in apartment buildings from the perspectives of the involved residents. It is of value since it observed the social reality prudently through conducting in-depth interviews, investigating the processes,

implications and structures of the issue by using Grounded Theory.

## 2. Methods

Semi-structured interviews were conducted with 16 interviewees. The questions for guidance had been prepared ahead of time; the interviewees were given the freedom to express their views in their own languages and expressions. The interviews took 30 to 60 minutes to complete at the interviewees' homes, meeting rooms or cafés. All interviews started after the interviewees signed off consent forms about confidentiality and voice-recording.

### 2.1. Recruitment of interviewees

Most interviewees had experienced a wide range of noise sources from their upstairs such as footsteps, vacuum cleaners, dropped items and scraping furniture. They had experienced different levels of noise annoyance and had made various types of complaints. Four of them not only had complained to neighbours but also had contacted relevant organisations to make official complaints, whereas five interviewees had never made any complaint about noise from upstairs.

Distributions of the interviewees are shown in Table I.

Table I Distribution of the interviewees (n=16)

<b>Age</b>	20s	1
	30s	10
	40s	3
	50s	2
<b>Gender</b>	Male	6
	Female	10
<b>Noise annoyance level</b>	Extremely annoyed	6
	Moderately annoyed	6
	Slightly or not annoyed at all	4
<b>Complaint level</b>	Extremely high	4
	Moderately high	3
	Low	4
	Haven't made any complaint	5
<b>House age</b>	Less than 5 years	4
	5 to 10 years	4
	10 to 15 years	4
	15 to 20 years	3
	Over 20 years	1
<b>Homeownership type</b>	Owned	5
	Rented (deposit rent)	10
	Rented (monthly rent)	1

## 2.2. Interview

Each interviewee was asked to fill in a printed version of pre-interview questionnaire before the interview. This questionnaire was used to collect basic information of the interviewees including their demographic factors. As guidance, questions for the interview were developed in several categories which are shown in Table II.

Table II Categories of the interview questions

- Reason for choosing the house
- Relationship with neighbours
- Noise sensitivity
- Other noise sources
- Sources of floor impact sounds and their effects
- Coping behaviours
- Experience of making complaints
- Opinion on main reason, responsibility and possible solutions
- Health problems

In order to measure each interviewee's noise sensitivity which has been found as one of the most significant factors for noise annoyance [20], the pre-interview questionnaire asked them to score their noise sensitivity on the 11-point scale and general questions about their noise sensitivity were asked again during the interview.

## 2.3. Analysis: Grounded Theory

The data was analysed by using Grounded Theory which is a set of rigorous research procedures to make conceptual categories emerge. Three coding phases (open, axial and selective) were used to analyse the interviewees' responses.

### 2.3.1. Open coding

One of the prior aims of the coding phase was immersion in the data; key questions for this coding stage (e.g., *How and what aspects of the phenomenon are addressed?*) were kept asking [21]. The transcribed data was examined line by line to identify significant concepts in narratives; headings were written down to categorise the data. After attempting to become more fully aware of the experiences of individuals, irrelevant information in each interview was excluded.

### 2.3.2. Axial coding

Emerged categories which had considerable similarities were grouped together under higher-order headings and core variables were discovered. A paradigm which has proved to be of value to explain the relationships between categories that relate to partial features of social action [21] was developed to show more clear explanation of the issue. According to Juliet Corbin, basic components of the paradigm are as follows:

Table III Basic components of the paradigm [22]

<b>Conditions</b>	Conditions allow a conceptual way of grouping answers to the questions about why, where, how and what happens.
<b>Inter/actions</b>	Actions or interactions are the responses made by individuals to situations, problems, happenings and events.
<b>Consequences</b>	Consequences are outcomes of actions or interactions responses to events. These answer the questions about what happened as a result of those actions or interactions or emotional responses.

Key questions were also asked, for example, *With what are the actions and interactions in the data actually concerned? What causal conditions contribute to the occurrence or development of the phenomenon?* [21]

### 2.3.3. Selective coding

The core variables were refined through checking, qualifying and elaborating. Guiding

questions such as *What is the issue here? What relationships exist?* [21] were repeatedly asked. Through a continuous review, compare and revise of data which had been already coded once at former stages, saturation was reached. Saturation is the point at which no new insights are gained, no new ideas are discovered and no issues arise in each category [23].

### 3. Results

The data was systematically analysed by using Grounded Theory. The sampling of the audio recordings was useful in discerning certain nuances regarding each individual's feelings and experiences which were not clear in their actual spoken words.

#### 3.1. Concepts and categories

A number of concepts which were related to noise annoyance and its reactions were identified. These concepts were grouped into categories and were revised again in light of the connections between them. Additional categories were developed if necessary. Table IV lists the identified concepts and categories.

Table IV Developed concepts and categories

Category	Concept
<b>Past experience</b>	Have (or haven't) experienced the issue in the past. Family members or friends have experienced the issue.
<b>Actual interference</b>	Resting or sleeping. Concentration or studying.
<b>Noise sensitivity</b>	Sensitive (or not sensitive). Some situations or sensitive family members cause noise sensitivity.
<b>Coping behaviour</b>	Using earplugs or turning up the volume of TV or music. Spending time outside. Visiting neighbours to complain. Asking security officers to make complaints. Making official complaints.
<b>Empathy</b>	Trying to understand neighbours.
<b>House or neighbourhood satisfaction</b>	Have been satisfied (or dissatisfied) with the house or neighbourhood. <i>e.g., because of noise, temperature, layout, size, location etc.</i>

<b>Health problem</b>	Tiredness or sense of fatigue. Eye problems. Stomach-ache or indigestion. Headache or dizziness.
<b>Attitude</b>	Have positive (or negative) expectations of the issue. Have personal opinions on the main reason for the problem. <i>e.g., lack of relationship with neighbours, problem of relevant policies, poor construction etc.</i> Have been satisfied (or dissatisfied) with results after making complaints. <i>e.g., security officer's way of dealing the issue, complicated process to make official complaints etc.</i>
<b>Relationship</b>	Relationship became worse after making complaints. Vindictive noise transmission from neighbours.
<b>Avoidance</b>	Have considered moving house.

Coding paradigm (Figure 1) was developed to explain relationships between the emerged categories and the main phenomenon of the research.

#### 3.2. Causal conditions

Noise sensitivity was found to be a significant causal condition that contributes to the occurrence of noise annoyance.

*I'm not that sensitive to noise. There hasn't been such inconvenience to me so far.*  
(Interviewee 1)

Interference with individuals' home lives was observed to increase noise annoyance. Eleven interviewees stated that they had heard the noise when they were about to go to bed at night or while they were sleeping.

*I can hear it the most when I'm about to go to bed, when I'm lying in my bed.*  
(Interviewee 3)

*They make noise after midnight, regularly.*  
(Interviewee 4)

Moreover, past experience of the issue was shown to increase one's noise annoyance level; both personal and others' experiences were found to increase annoyance.

*I was so stressed as it was so noisy in my previous house. It was an apartment building as well. But the problem is, I think it's the same over here. Or worse.* (Interviewee 17)

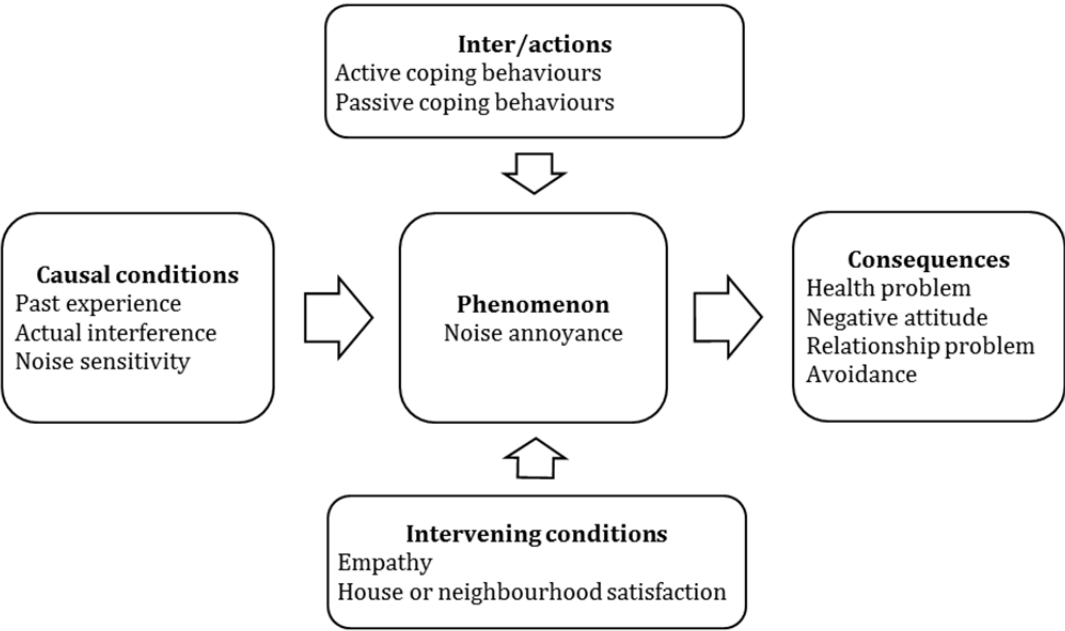


Figure 1 Developed paradigm

*I heard that my mom had experienced this problem before. Two children had been living her upstairs and had made so much noise. She had been so stressed. She had complained to them several times. (Interviewee 4)*

3.3. Inter/actions

A number of coping behaviours were stated by the interviewees as shown in Table V and they were grouped into active and passive coping behaviours.

Table V Described coping behaviours

Active	<ul style="list-style-type: none"><li>• Visiting neighbours to complain.</li><li>• Making complaints through security office.</li><li>• Making official complaints through relevant mediating organisations.</li></ul>
Passive	<ul style="list-style-type: none"><li>• Using earplugs.</li><li>• Going out.</li><li>• Trying to concentrate on other activities.</li><li>• Turning up the volume of the TV or music.</li><li>• Giving up.</li></ul>

3.4. Intervening conditions

As intervening conditions, empathy and satisfaction with house or neighbourhood were found to influence each individual’s frequency or level of inter/actions. The term empathy was used to explain an emotional or a situational status which made one understand or be

sympathetic to upstairs neighbours who had been responsible for the noise. In other words, those who also had transmitted noise to their downstairs or had received complaints about noise from downstairs neighbours in the past were more likely to have empathy.

*I’m just trying to be sympathetic as we’ve received noise complaints from people downstairs. (Interviewee 16)*

Satisfaction or dissatisfaction with house or neighbourhood was also found to influence the frequency or level of coping behaviours.

*I chose this house as I liked it and this neighbourhood. Except those people (upstairs neighbours), I really like living in this house, I’m satisfied with it. (Interviewee 9)*

*It’s too small and the people upstairs are so noisy. And I don’t like living in front of the lift. (Interviewee 2)*

3.5. Consequences

Consequences were discovered with or without reduction of noise annoyance stemming from floor impact sounds. With no reduction of it, individuals were found to be prone to experience some health problems, consider moving house as avoidance behaviour and have negative attitudes on the issue or relevant authorities; they were more likely to have relationship problems with their neighbours. Several interviewees reported their negative attitudes to noise sources, their neighbours, current house or relevant authorities

after experiencing constant annoyance and making complaints. Additionally, some of them not only thought that this problem would not be solved, but that it would become worse in the long term.

*It'll become worse. I mean, everyone's getting more individualistic and stressed so all of us will become more sensitive to noise and everything. (Interviewee 16)*

*There're problems in our policy. And there're problems in neighbours' personality as well. (Interviewee 8)*

#### 4. Discussions

It is interesting to note that the development of each individual's noise sensitivity could be influenced by their family members who were sensitive to noise or changes in situations. Some interviewees stated that one of their family members who were sensitive to noise made them more sensitive to noise; some reported that their sensitivities to noise have changed due to situational changes.

*My husband is so sensitive to noise. Actually I wasn't sensitive at all before, but became sensitive. (Interviewee 5)*

*Compared with the past, now I'm much more sensitive than before. I even didn't hear or realise any noise in my house before but I think I changed after having a baby. (Interviewee 4)*

*After I started working for this job, I think I became more sensitive. (Interviewee 13)*

It was observed that closeness or good relationship with neighbours could be one of the significant factors that influence the occurrence of noise annoyance; it could be a factor that moderates the level or frequency of one's coping behaviours. This implies that conflicts between residents due to floor impact sounds could be mitigated by promoting better relationships between neighbours.

#### 5. Conclusions

All interviewees, but one, reported that they spent more than a third of the day in their houses (14 hours a day on average) and noises which they had been exposed to had caused noise annoyance. This study explored and attempted to explain non-acoustic factors which are related to

noise annoyance caused by floor impact sounds with the employment of Grounded Theory.

Through the analysis of data collected from semi-structured interviews, noise sensitivity, past experience and actual interference were found to be causal conditions to increase higher noise annoyance. Passive coping behaviours such as turning up the volume of TV or trying to concentrate on other activities were shown to be common reactions that individuals have taken in the earlier stage of noise exposure. Those who had empathy with their neighbours were found to be reluctant to make complaints. It is because they could understand their neighbours for they also had passed noise to their downstairs neighbours or received noise complaints in the past. However, some interviewees had taken active reactions such as making official complaints through relevant authorities after they had been exposed to the noise continuously. It was found that those who had been cautious about passing noise to their downstairs neighbours stated more negative evaluation of their upstairs neighbours who had been passing noise. Moreover, those who were satisfied with their houses or neighbourhood tended to make noise complaints more than those who had low level of satisfaction.

This study also shows how individuals were prone to adopt negative attitudes following noise annoyance. If the exposure of noise were not reduced and caused noise annoyance constantly in spite of taking several coping strategies, one could experience different types of health problems and have negative attitudes to the issue or relevant authorities. In addition, they could have negative relationships with their neighbours and consider moving house as one of the avoidance behaviours.

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